

```
In [26]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
```

```
In [27]: df = pd.read_csv("AirPassengers - AirPassengers.csv")
```

```
In [28]: df
```

Out[28]:

	Month	#Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121
...
139	1960-08	606
140	1960-09	508
141	1960-10	461
142	1960-11	390
143	1960-12	432

144 rows × 2 columns

```
In [29]: df.head(10)
```

Out[29]:

	Month	#Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121
5	1949-06	135
6	1949-07	148
7	1949-08	148
8	1949-09	136
9	1949-10	119

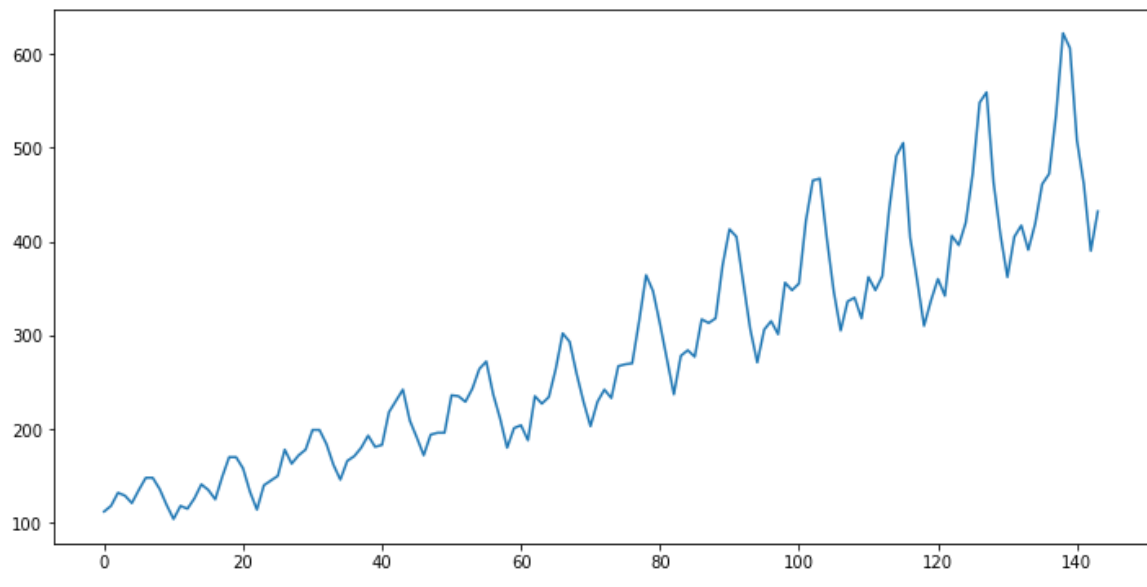
In [30]: `df.tail(10)`

Out[30]:

	Month	#Passengers
134	1960-03	419
135	1960-04	461
136	1960-05	472
137	1960-06	535
138	1960-07	622
139	1960-08	606
140	1960-09	508
141	1960-10	461
142	1960-11	390
143	1960-12	432

In [31]: `plt.rcParams.update({"figure.figsize" : (12,6)})`
`df["#Passengers"].plot()`

Out[31]: <AxesSubplot:>



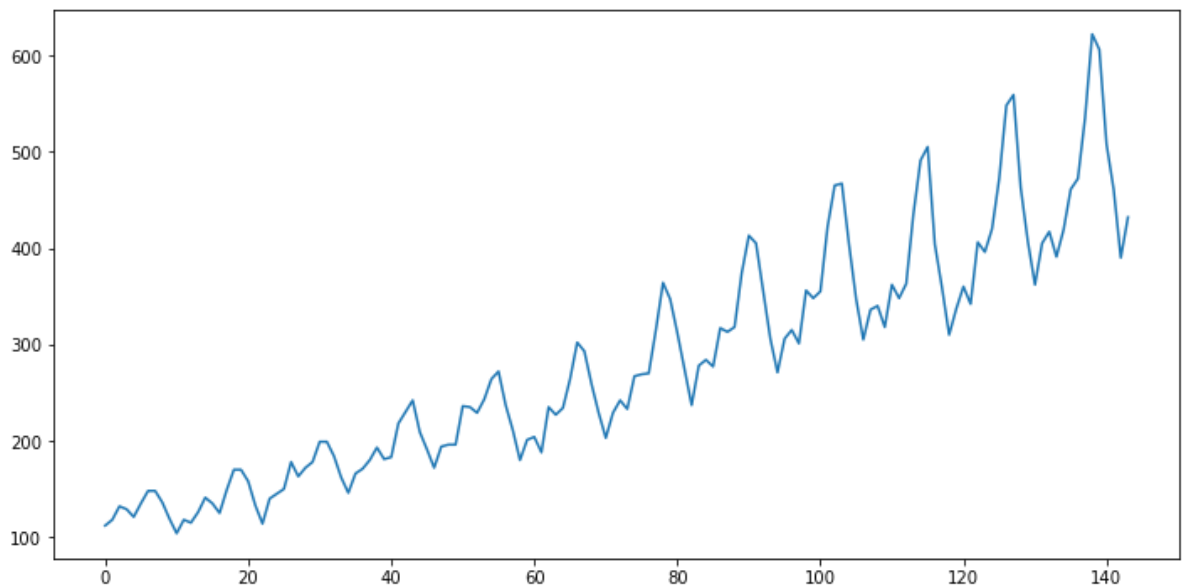
Method 1 : Differencing and seasonal differencing

In [32]: `#Differencing meaning $y(t) = y(t) - y(t-1)$`

In [33]: `df["Passengers_diff"] = df["#Passengers"] - df["#Passengers"].shift(1)`

```
In [34]: df["#Passengers"].dropna().plot()
```

```
Out[34]: <AxesSubplot:>
```



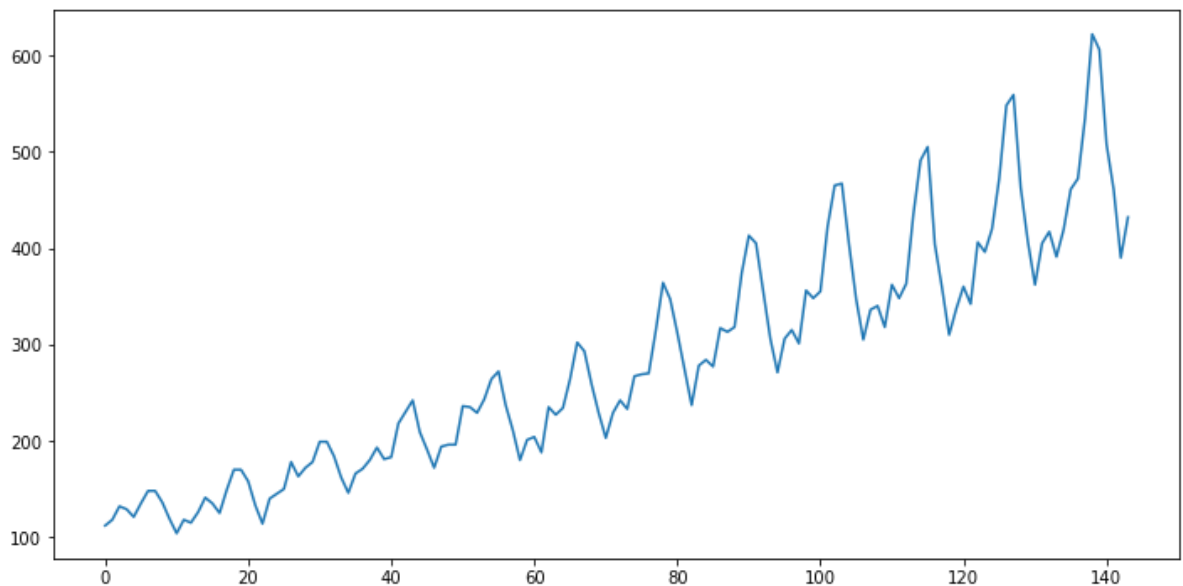
Now see the after seven days sales

```
In [35]: # sesonal differencing meaning  $-y(t) = y(t) - y(t-n)$ 
```

```
In [36]: df["Passengers_diff"] = df["#Passengers"] - df["#Passengers"].shift(7)
```

```
In [37]: df["#Passengers"].dropna().plot()
```

```
Out[37]: <AxesSubplot:>
```



Method 2 : Transformation

```
In [38]: # create transformation columns
import numpy as np

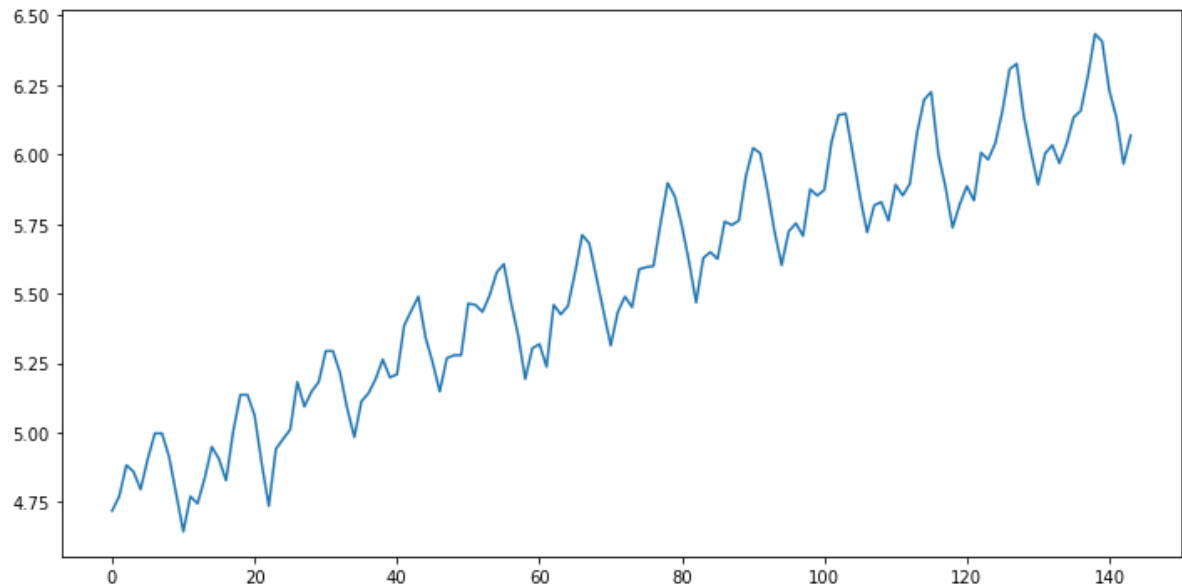
# calculate the log
df["adj_log"] = np.log(df["#Passengers"])

# calculate the square root
df["adj_sqrt"] = np.sqrt(df["#Passengers"])

# calculate the cubed root
df["adj_cbrt"] = np.cbrt(df["#Passengers"])
```

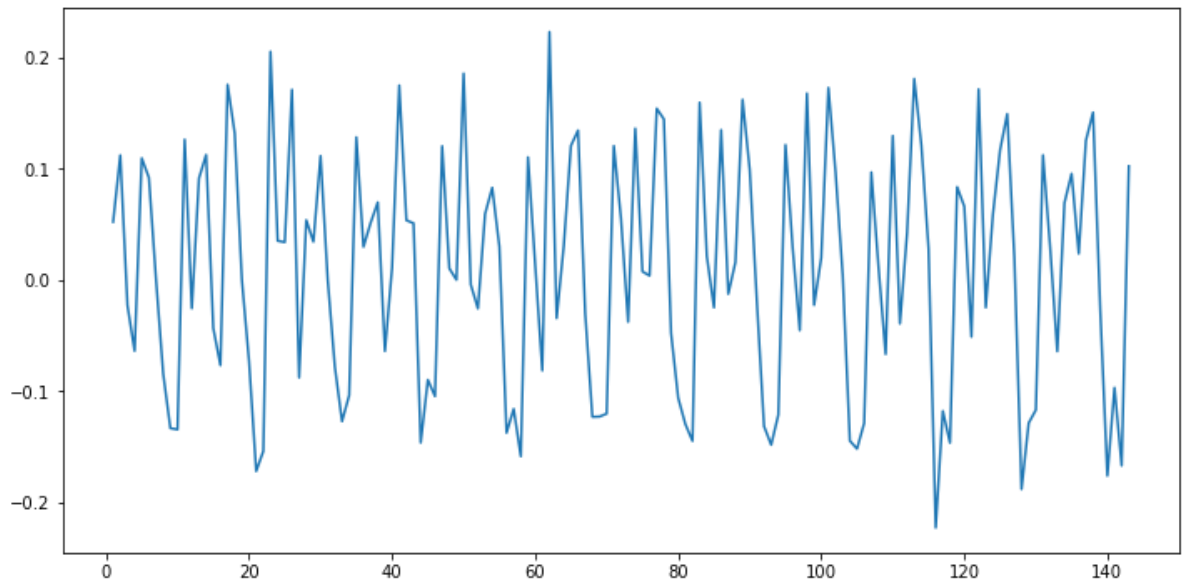
```
In [40]: df["adj_log"].dropna().plot()
```

Out[40]: <AxesSubplot:>



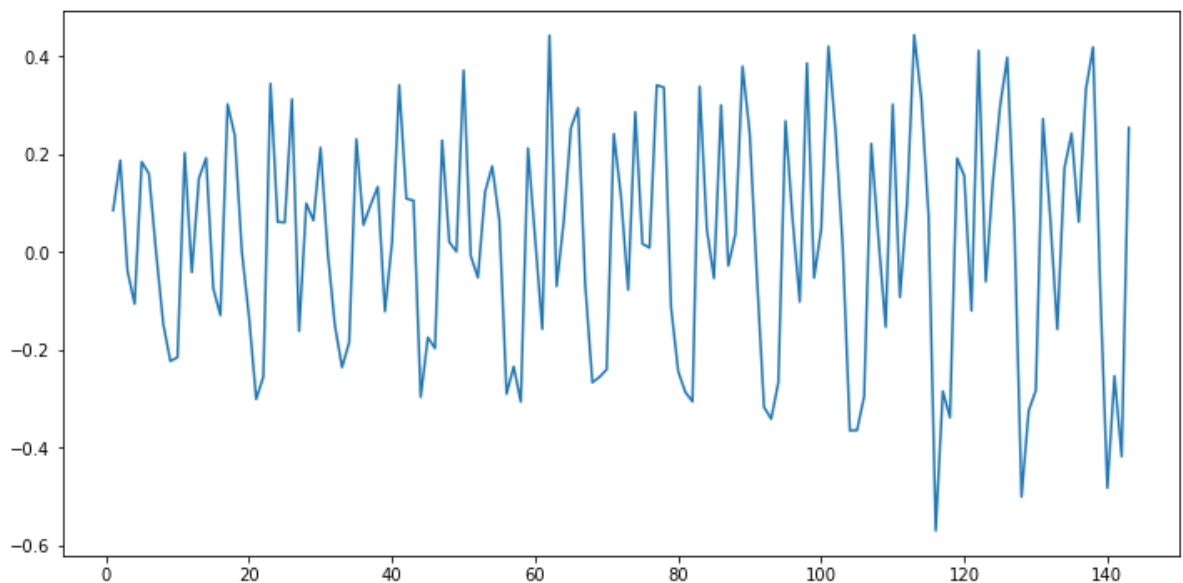
```
In [44]: df["#Passengers_log_diff"] = df["adj_log"] - df["adj_log"].shift(1)
df["#Passengers_log_diff"].dropna().plot()
```

Out[44]: <AxesSubplot:>



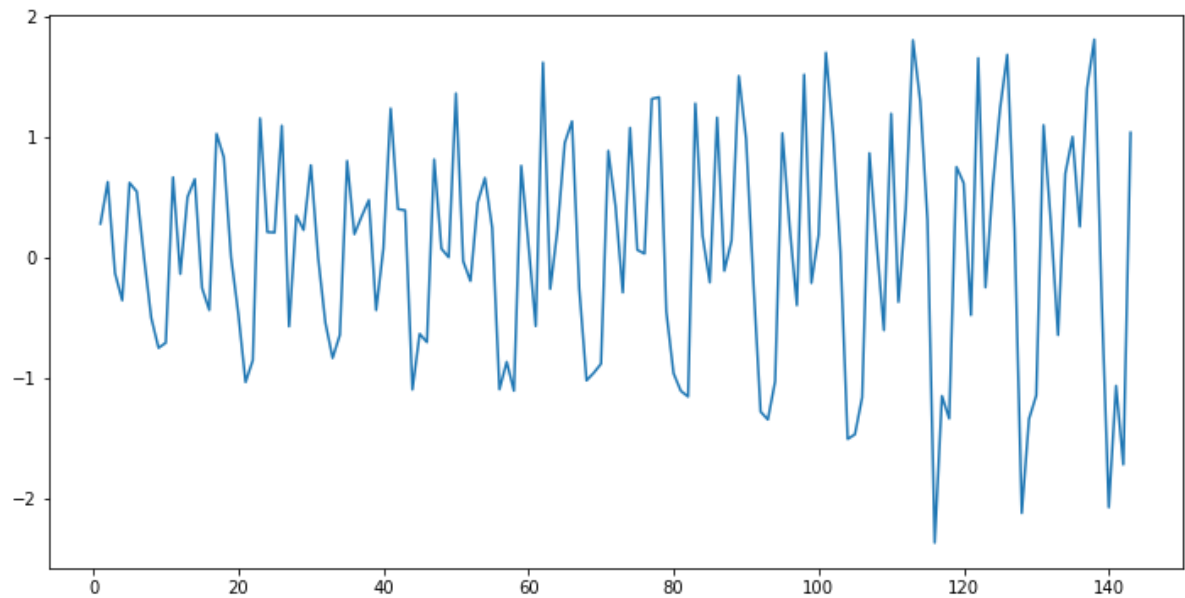
```
In [45]: df["#Passengers_cbrt_diff"] = df["adj_cbrt"] - df["adj_cbrt"].shift(1)
df["#Passengers_cbrt_diff"].dropna().plot()
```

Out[45]: <AxesSubplot:>



```
In [46]: df["#Passengers_sqrt_diff"] = df["adj_sqrt"] - df["adj_sqrt"].shift(1)
df["#Passengers_sqrt_diff"].dropna().plot()
```

Out[46]: <AxesSubplot:>



In []: